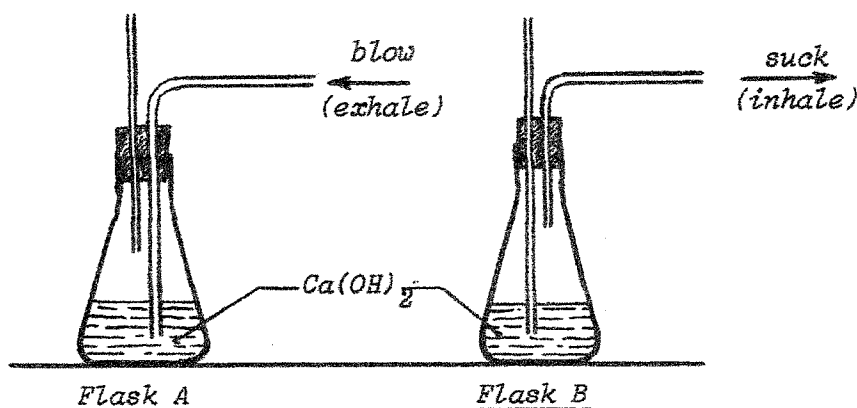


17.21. WHICH CONTAINS MORE CARBON DIOXIDE?

- Materials:
1. Two Erlenmeyer flasks.
 2. Two sets of glass tubing in 2-hole stoppers (see sketch).
 3. Saturated lime water (calcium hydroxide).

Procedure:

1. Make a saturated solution of calcium hydroxide by adding small amounts of the solid powder, a little at a time to warm water while stirring, until no more solid dissolves.
2. Fill each flask half full with the lime water and cover them with the two-hole rubber stoppers (and fitted glass tubing).
3. Suck through the tube which ends above the water surface in flask A and exhale through the tube that extends into the liquid in flask B (see sketch).

Questions:

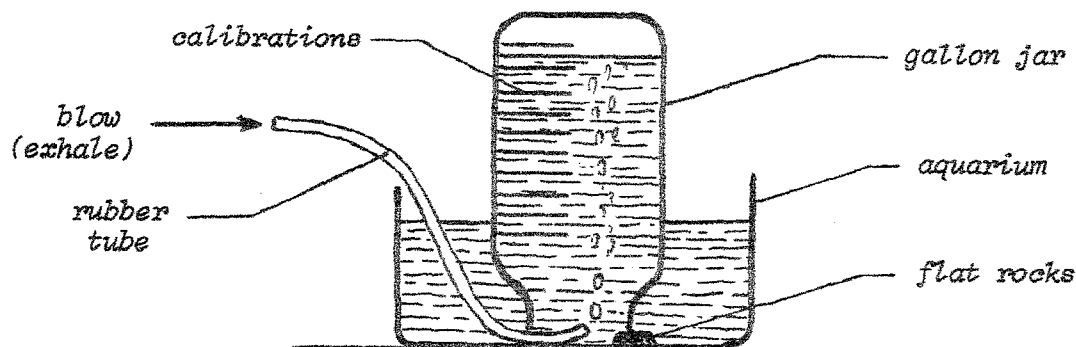
1. Which of the two flasks is getting milky first?
2. What gas is actually led through the liquid in flask A?
3. What does it indicate if the liquid turns milky?
4. What chemical reaction is taking place?
5. Will flask A eventually also turn milky if the sucking is continued?
6. What will the liquid in flask B eventually do if the blowing through it is continued?
7. Which of the two, inhaled or exhaled air, contains more CO_2 ?

Explanation:

By sucking through the tube in flask A, atmospheric air is led through the saturated calcium hydroxide solution (this air is the same as the air we inhale). By blowing through the tube in flask B, exhaled air is led through the liquid, which turns milky sooner than that in flask A. This indicates that there is more CO_2 present in exhaled air. The reaction is as follows: $\text{CO}_2 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$, in which the calcium carbonate precipitates out and makes the solution appear milky. The CO_2 in the air will eventually turn the liquid in flask A also milky, and when the blowing is continued in flask B, the reaction: $\text{CO}_2 + \text{CaCO}_3 + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{HCO}_3)_2$ will turn the liquid clear again (Ca-bicarbonate is soluble in water).

17.22. MEASURE THE CAPACITY OF YOUR LUNGS

- Materials:
1. A large glass jar (pickle gallon jar).
 2. An unused aquarium (or other transparent container).
 3. A length of rubber tubing (about 40 cm long).
 4. A 1 litre measuring cylinder (or other litre container).

Procedure:

1. Calibrate the large jar by filling it with water, litre by litre, and marking the water level with a marker or masking tape.
2. Fill the gallon jar completely full and the aquarium $\frac{3}{4}$ full with water.
3. Place three flat stones of the same thickness (or other heavy objects) on the bottom of the aquarium, and invert the gallon jar into the water-filled aquarium so that it rests on the three stones.
4. Insert one end of the rubber tubing under the mouth of the gallon jar and let the other end hang over the rim of the aquarium.
5. Let one student hold the inverted jar steady and another student, whose lung capacity is to be measured, exhale through the tube after inhaling as deeply as he/she can.
6. Measure volume of exhaled air in jar.

Questions:

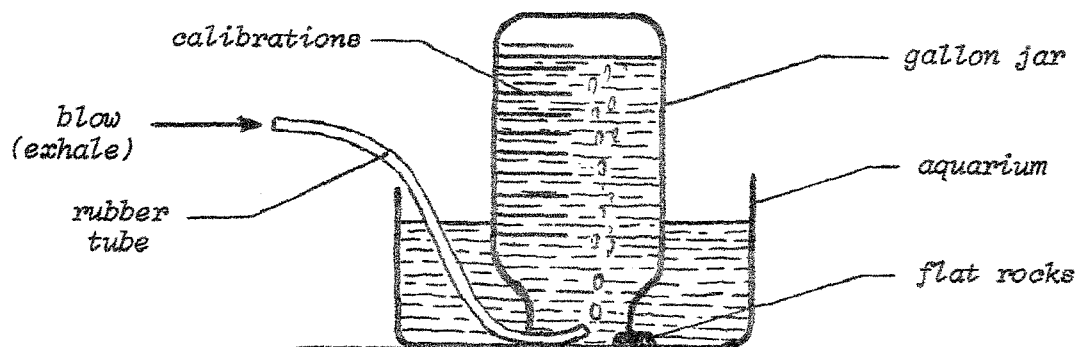
1. What made the water stay up in the inverted jar?
2. Why did the student have to inhale as deeply as possible before inhaling?
3. In exhaling, what does the student have to do in order to obtain a true measure of his/her total lung capacity?

Explanation:

By inhaling as deeply as we can, we are actually filling our lungs full with air. When we blow all the air out through the tube and catch this exhaled air in the jar above the water, the volume or capacity of our lungs can thus be measured. This we do by reading off the volume of air in the jar. The larger this lung capacity, the more it is indicating that the individual involved is enjoying better health.

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